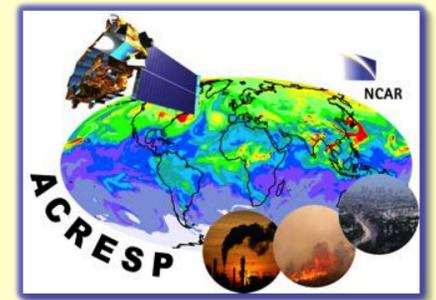




Multispectral Retrieval of Near-Surface Carbon Monoxide by MOPITT

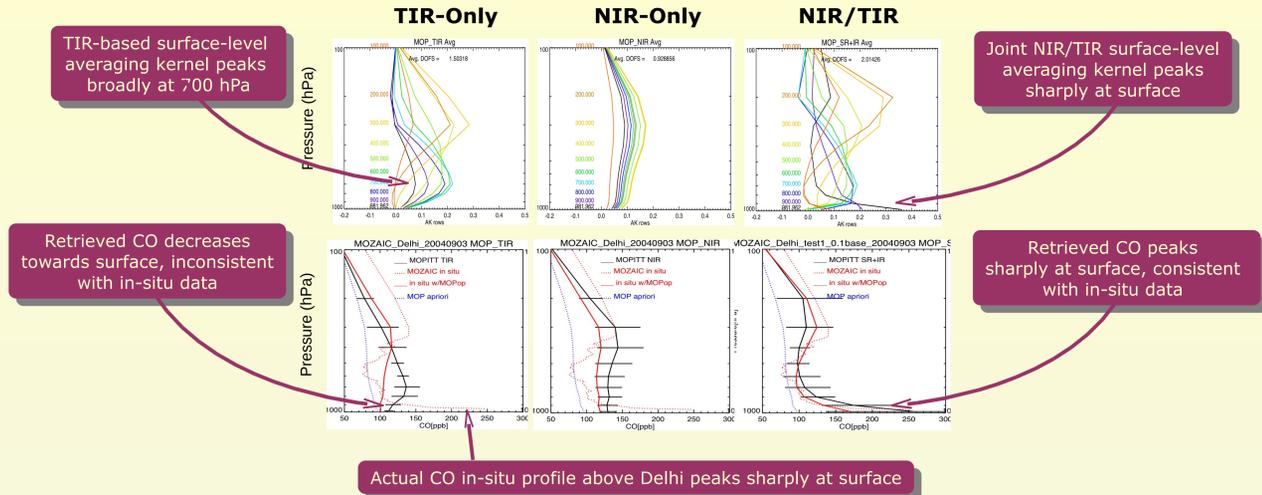


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The Future of Satellite-based CO Retrievals

The Measurements of Pollution in the Troposphere (MOPITT) instrument observes the troposphere in both near-infrared (NIR) and thermal-infrared (TIR) absorption bands of carbon monoxide (CO) using principles of gas-filter correlation radiometry. MOPITT has already acquired nearly ten years of TIR and NIR observations. Because of the complementary vertical sensitivities (i.e., weighting functions or 'Jacobians') of NIR and TIR radiances, retrievals based on both NIR and TIR radiances are fundamentally much more capable of characterizing surface-level CO than either purely TIR- or NIR-based products. While current operational MOPITT products are based on TIR radiances only, joint 'multispectral' NIR/TIR products are maturing rapidly. Developmental NIR/TIR products based on MOPITT observations clearly demonstrate the advantage of multispectral retrievals of CO, especially for revealing sources and determining near-surface concentrations.

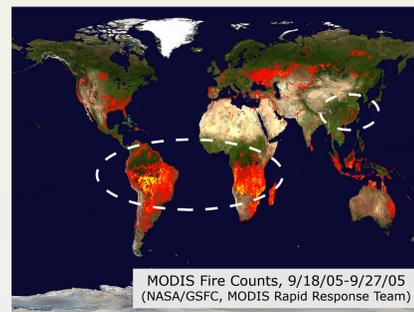
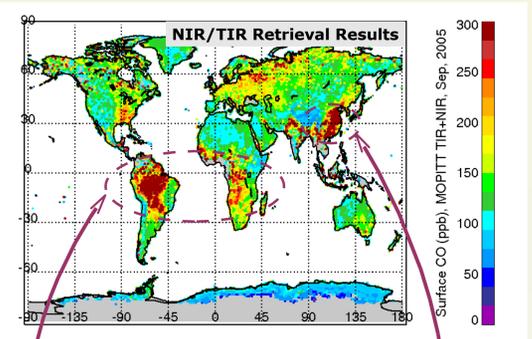
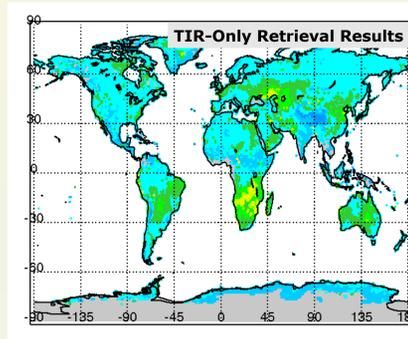
Case Study: Polluted Boundary Layer over Delhi, India



Global Comparison of TIR-only and NIR/TIR Surface-level CO: September, 2005

MOPITT TIR radiances alone reveal patterns of mid-tropospheric CO

Together, MOPITT NIR and TIR radiances reveal known CO source regions in S. America, Africa, and Asia:

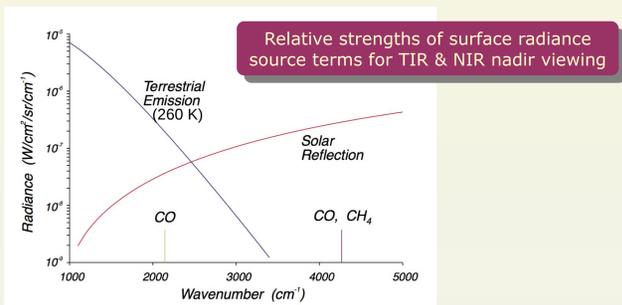
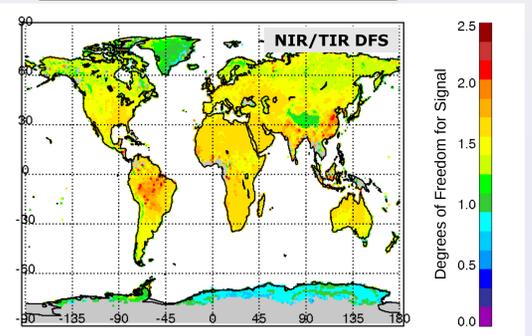
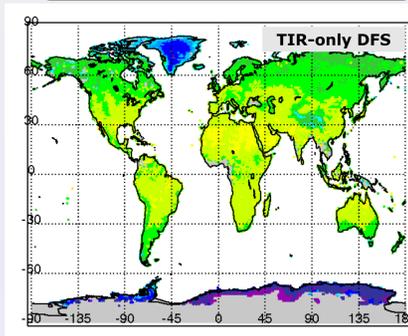


Biomass burning source regions in S. America and Africa in MOPITT NIR/TIR data consistent with MODIS fire maps
 CO produced by fossil fuel burning in E. Asia clearly visible in MOPITT NIR/TIR data (lack of fires in MODIS imagery indicates anthropogenic source)

Global Comparison of TIR-only and NIR/TIR Degrees of Freedom for Signal: September, 2005

TIR-only DFS values over land typically vary from 1 to 1.5; highest values usually in deserts

NIR/TIR DFS values typically vary from 1.5-2; highest values in source regions in S. America, Africa, and Asia



TIR-only CO Retrievals:

- ✓ MOPITT V4, AIRS, TES, IASI
- ✓ Day/Night
- ✓ Land/Ocean
- ✓ Thoroughly validated
- ✓ High SNR (strong absorption at 4.6 um)
- ✓ Mainly sensitive to mid- and upper-trop CO
- ✓ Typical DFS ~ 1-1.5

NIR-only CO Retrievals:

- ✓ SCIAMACHY
- ✓ Daytime only (problematic for polar regions)
- ✓ Land or Ocean w/ Low Clouds
- ✓ Low SNR (weak absorption at 2.3 um)
- ✓ Primarily sensitive to CO total column
- ✓ Max. DFS ~ 1

Joint NIR/TIR CO Retrievals:

- ✓ MOPITT V5 (in development, available 2010)
- ✓ Best performance in daytime observations over land, otherwise products are TIR-only
- ✓ Qualitatively validated
- ✓ Enhanced surface-level sensitivity confirmed
- ✓ Typical DFS ~ 1.5 -2

